

## NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river-gauges for the month, with the dates of the same. The *Missouri* remained frozen over at and above Omaha, throughout the entire month. At Omaha, on the 21st, the ice melted in the immediate vicinity of the gauge and observations on height of river were resumed; the water slowly fell from the above date to the end of the month; at Leavenworth the observations were resumed on the 7th, and the river remained low throughout the month. The *Mississippi* remained closed at and above Le Claire; observations were resumed at Dubuque on the 18th, at Davenport on the 7th, and at Keokuk on the 3rd; at Dubuque and Davenport the river continued to fall to end of month; at Keokuk it rose to 10 feet on the 4th, fell to 6 feet on the 8th, rose to 8 feet on the 10th, after which it fell to end of month; at St. Louis it rose from 1st to 10th, and then fell to end; at Cairo it fell from 37 feet 4 inches (within 3 feet of danger line) on the 2nd to 33 feet 7 in. on the 8th, rose to 42 feet 11 in. (3 feet above danger line) on the 16th, and then fell to 24 ft. 7 in. by end; at Memphis rose from 27 ft. 7 in. on 1st to 32 ft. 5 in. (within 19 in. of danger line) on the 19th, then fell to end; at Vicksburg it rose from 30 ft. 11 in. on the 1st to 40 ft. 11 in. (danger line 41 ft.) at end of month; at New Orleans it rose from the 1st to the end of month, when it was within 9 in. of the danger line. The *Tennessee*, at Chattanooga, fell from the 1st to 6th, rose to 11th and fell to end of month. The *Cumberland*, at Nashville, fell from 1st to 6th, rose to 9th to 16 ft. 6 in., it then remained almost stationary to the 15th, after which a general fall set in which continued to end. The *Ohio*, at Pittsburg, fell from 15 ft. on the 18th to 11 ft. 7 in. on the 5th, rose to 17 ft. 3 in. on 7th, fell to 6 ft. 2 in. on the 16th, rose to 9 ft. 3 in. on 22nd, and fell to end of month; at Cincinnati it arose from 24 ft. on 2nd to 42 ft. 2 in. (8 ft. below danger line) on 9th, and fell to 19 ft. 3 in. at end; at Louisville it fell from 14 ft. 6 in. on 1st to 9 ft. 6 in. on 4th, rose to 19 ft. 6 in. (5 ft. from danger line) on the 8th, and fell to end of month. The *Savannah* oscillated between 6 and 7 ft. from 1st to 8th, rose to 13 ft. 6 in. on the 10th, fell to 6 ft. 8 in. on 21st, rose to 12 ft. on 28th and fell to end.

*Ice in Rivers and Harbors.*—The following notes on the formation of ice are of interest: *Columbia River.*—Portland, Or., 3rd, navigation between this city and the cascades reopened; river nearly clear of ice. *Fraser.*—New Westminster, river open on the 16th. *Missouri.*—Yankton, Dak., and Omaha, Neb., river frozen over throughout the month. Plattsmouth, Neb., 8th, ice in river very rotten but held in place by the pile bridge and lack of a rise; 19th, ice breaking up and moving slowly; 20th to 28th, small ice gorges forming at several places, but finally freezing over the second time on the 29th. St. Joseph, Mo., 8th, ice breaking up; 10th, river clear of ice. Leavenworth, Kan., 5th, ice melting rapidly; 6th, breaking up; 7th, ice gorged, carrying away river gauge and causing other damage; 8th, 9th, river full of floating ice; 10th, river clear; 29th, 30th, 31st, floating ice in river. Kansas City, Mo., 5th, ice breaking up; 6th, 7th, 8th, ice running out of river; 9th, river clear of ice; 11th, floating ice. Brunswick, Mo., 5th, drift wood in river, destroying river gauge. Boonville, Mo., 4th, ice breaking up, gorges forming. *Platte River.*—Clear Creek, Neb., 1st, 8th, 19th, floating ice in river; 28th, river frozen over hard. Plattsmouth, Neb., 12th, ice melting rapidly, dangerous for travel. *Mississippi.*—La Crosse, 18th, ice on river becoming soft and unsafe for travel, but throughout the month the river remained closed. Dubuque, Ia., 12th ice breaking up; 15th, frozen over; people crossing on the ice; 16th, open in several places; 18th, all travel across river ceased; 19th, ice breaking up; 21st, floating ice; 26th, river nearly clear of ice; 27th, ferry-boats making trips; 31st, river full of floating ice. Le Claire, Ia., 31st, river entirely frozen over. Davenport, Ia., 4th, ice breaking up; 5th, 6th, 7th, 8th, gorged, causing considerable damage to wharves; 9th, floating ice; steamer arrived from Le Claire; floating ice also on the 12th, 13th, 14th, 15th, 23rd, 24th, 28th to 31st. Muscatine, Ia., 9th, ice breaking up; 18th, river clear. Burlington, Ia., 6th, ice breaking up; all travel across the river ceased; large ice floes floating down the river; 8th, river clear; 10th to 16th, floating ice; 18th, river clear; 31st, large quantities of floating ice. Fort Madison, Ia., 30th, first boat passed down the river; river clear of ice. Keokuk, Ia., 2nd, ice breaking up; 3rd, moving out slowly; 4th, ice gorged in places, river rising rapidly; 5th, heavy floating ice, gorged in places; river clear along the Illinois side, but closed on the Iowa side; considerable damage done to bridge piers; 6th, Iowa side and main channel clear; navigation opened; river falling rapidly; 8th, steamer arrived from Montrose; 9th and 10th, heavy floating ice; 11th to 13th, small quantities of floating ice; 14th, heavy floating ice; 15th, heavy floating ice; steamer Arkansas left for St. Louis; 16th, first boat arrived from St. Louis; small quantities of floating ice; 17th to 24th and 29th, floating ice; 31st, heavy floating ice. St. Louis, 1st, 2nd, 3rd, 4th, small quantities of floating ice in river; navigation resumed; 5th, river clear of ice; 8th, drift-wood in river. Cairo, Ill., 1st to 3rd, floating ice in river. *Iowa.*—Des Moines, Ia., 9th, ice breaking up and floating out rapidly. *Rock river.*—Rockford Ill., 6th, floating ice in river; 7th, river clear of ice; 29th, floating ice. Lyndon, Ill., 5th, ice passed out of river, causing serious inundations wherever gorges were formed. *Kishwaukee.*—Belvidere, Ill., 4th, river rising rapidly, mill-dam destroyed by floating ice. *Ohio river.*—Wellsburg, W. Va., no ice in the river, at this point, this winter. *Lake Superior.*—Duluth, 14th, ice in harbor breaking up and drifting away; 21st, large quantities of floating ice in bay; 22nd, ice forming in lake rapidly. *Lake Michigan.*—Chicago, 3rd, ice breaking up in river and along lake front. *Grand Traverse Bay.* Northport, Mich., bay free of ice throughout the month. *Detroit river.*—Detroit, 1st to 3rd, ice forming along shore; 9th to 14th, floating ice; 15th, clear of ice. *Lake Erie.*—Toledo, 4th and 5th, ice breaking up and running out; 7th, free of ice; 10th, navigation opened between this port and Detroit;

15th, tug Carrington left for Port Sarnia. Cleveland, 21st, scow arrived loaded with stone, first boat since close of navigation. Sandusky, 3rd, ice breaking up; 5th, large masses moving out; 9th, first steamer arrived. Buffalo, 1st, creek and harbor free of ice. *Hudson River*.—Albany, 28th, river entirely free of ice, rose 11 feet in past 36 hours, causing considerable damage to property. *Watuppa Lake*.—Fall River, Mass, lake clear of ice throughout the month. *Lake Champlain*.—Burlington, Vt., 1st, 22nd to 25th, 28th, 31st, floating ice in lake. *Merrimac River*.—Newburyport, Mass, river and harbor free of ice throughout the month, except on the 1st, 14th, 27th, 28th, 30th, when small quantities of floating ice appeared.

*High Tides*.—Cape Lookcut, N. C., 14th, 15th, 26th, Fort Macon, N. C., 11th, 12th, 13th to 16th; Portsmouth, N. C., 14th,

*Low Tides*.—Indianola, Tex., 1st, 2nd, 10th, 11th and 12th.

## TEMPERATURE OF WATER.

The *temperatures of water*, as observed in rivers and harbors, with average depth at which observations were taken, are given in the table on left side of chart No. II. At the following stations observations were not made on the dates indicated, on account of ice, at Alpena and Escanaba during entire month; Chicago, 1st, 2nd and 3rd; Detroit, 1st, 2nd, 3rd, 10th, 11th, 12th; Duluth, 1st to 13th inclusive, 22nd to end of month; Grand Haven, 1st, 2nd and 3rd; Marquette, 28th to 31st; Sandusky and Toledo 1st to 6th.

## ATMOSPHERIC ELECTRICITY.

*Thunder-storms* were reported in the various states and territories on the following dates: Pennsylvania, 20th, 21st; New Jersey, Maryland, Virginia and West Virginia, 20th; North Carolina, 9th, 22nd; Georgia, 8th, 21st, 26th, 27th; Florida, 25th; Alabama, 17th, 21st; Mississippi, 21st, 22nd; Louisiana, 5th, 21st; Texas, 1st, 2nd, 3rd, 4th, 24th, 29th, 30th, 31st; Arkansas, 7th; Indian Territory, 29th; Tennessee, 6th, 21st, 22nd at Nashville the thunder-storm of the 21st was very severe, the heavy peals of thunder and vivid flashes of lightning, 10:10 p. m. being a marked feature of the storm; Kentucky, 7th, 8th, 21st; Ohio, 8th, 21st, 22nd; Illinois, 7th, 8th, 21st; Indiana, 7th, 8th, 12th, 17th, 21st; Missouri, 19th, 21st, 29th; Iowa and Nebraska, 29th; Kansas, 22nd, 29th.

*Auroras*.—Harvard College Observatory, Cambridge, Mass., looked for every clear evening, but none seen. Guttenburg, Ia., 28th, 9 p. m., diffuse light, no streamers; Independence, Ia., 16th; Gardiner, Me., 28th; Austin, Nebr., 4th; Starkey, N. Y., 11th, 20th, 24th; Milton, Pa., 11th, 7 p. m., arch extended from northeast to southwest, disappeared at 8:40 p. m.; Coalville, Utah, 30th; Tucson, Ariz., 8th; Eastport, 7th, 11:40 p. m., 8th, 3 a. m.; Newport, R. I., 4th, 11:30 p. m.; Burlington, Vt., 7th.

*Telegraphic Communication interfered with by Atmospheric Electricity*.—Mason, Tex., 2nd, 3rd; Davis, Tex., 1st, 2nd; Cape Hatteras, N. C., 22nd.

## OPTICAL PHENOMENA.

*Solar Halos* were observed in the various districts on the following dates: New England, 16th, 17th, 18th, 22nd, 24th, 25th, 26th, 28th, 29th; Middle Atlantic States, 2nd, 3rd, 5th, 16th, 17th, 18th, 19th to 30th; South Atlantic States, 1st, 3rd, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 22nd, 23rd, 24th, 25th, 27th, 28th; Eastern Gulf States, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 28th; Western Gulf States, 15th, 16th, 17th, 18th, 19th, 21st, 22nd, 23rd, 24th, 26th, 28th, 29th; Lower Lake region, 17th, 19th, 21st, 24th, 25th, 27th, 28th, 29th, 31st; Upper Lake region, 5th, 16th, 17th, 24th, 25th, 26th, 27th, 28th, 29th; Ohio valley and Tennessee, 1st, 2nd, 14th, 15th, 16th, 19th, 20th, 21st, 23rd to 29th; Upper Mississippi valley, 1st, 15th to 29th; Missouri valley, 2nd, 4th, 14th to 20th, 24th to 31st; Eastern Rocky Mountain slope, 1st, 2nd, 14th, 17th, 18th, 23rd, 25th, 27th, 28th; Rocky Mountains, 15th, 20th, 21st, 23rd, 24th, 29th; Western Plateau, 17th, 18th, 21st, 23rd, 24th, 26th, 27th; California, 2nd, 4th, 19th, 22nd, 24th, 25th, 26th.

*Lunar Halos* were observed in the various districts on the following dates: New England, 5th, 13th, 15th, 17th, 25th, 26th, 27th, 30th; Middle Atlantic States, 5th, 15th, 16th, 17th, 21st, 23rd, 25th, 26th, 30th; South Atlantic States, 20th, 21st, 23rd; Eastern Gulf States, 5th, 16th, 19th, 20th, 22nd, 23rd; Western Gulf States, 9th, 19th, 29th; Lower Lake region, 6th, 8th, 9th, 10th, 11th, 19th, 20th, 25th; Upper Lake region, 13th, 16th, 18th, 24th, 26th, 28th; Ohio valley, 1st, 14th, 24th, 25th, 26th, 28th, 29th; Upper Mississippi valley, 10th, 11th, 14th, 15th, 17th, 19th, 23rd, 24th, 25th, 26th, 28th, 30th, 31st; Missouri valley, 5th, 11th, 16th, 19th, 20th, 23rd, 24th, 25th, 26th, 27th, 28th; Rocky Mountains, 7th, 15th, 18th, 27th, 28th, 29th; California, 9th, 11th, 24th, 29th.

*Mirage*.—Olivet, Dak., 30th; Genoa, Neb., 17th, 18th, 22nd, 23rd, 24th, 30th, 31st; Pembina, Dak., 20th, 23rd, 24th.

## MISCELLANEOUS PHENOMENA.

*Sunsets*.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service Stations. Reports from 137 stations show 4,183 observations to have been made, of which 35 were reported doubtful; of the remainder, 3,486, or 84.0 per cent., were followed by the expected weather.

*Meteors*.—Wabash, Ind., 19th, between 5 and 6 a. m., "a large meteor passed over the city making the